

# Itanium®-based midrange servers from HP— the HP Integrity rx7620-16 and rx8620-32 Servers



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## Executive summary

Based on the revolutionary Intel® Itanium® 2 processor co-developed by HP and Intel, the HP Integrity rx7620-16 and rx8620-32 Servers bring you all the computing power you need to operate in the most demanding IT environments. This market-leading computing performance coupled with the flexibility and scalability of the Integrity rx7620-16 and rx8620-32 Servers allow you the kind of agility and investment protection you need to meet today's commercial and technical computing demands—all while cutting costs. HP Integrity servers are easily outpacing the performance of the competition by providing more power, more applications, additional features, and a broader range of solutions. And, with flexible configurations, competitive pricing, and financial incentives, the Integrity rx7620-16 and rx8620-32 Servers make high-availability 64-bit computing an affordable reality for your enterprise.

Powered by Intel Itanium 2 processors and supporting the industry's leading operating environments, including HP-UX, OpenVMS, Linux®, and Microsoft® Windows®, the HP Integrity rx7620-16 and rx8620-32 Servers give you the performance and financial flexibility to power every application from Web serving to mission-critical enterprise resource management. And with HP's clear roadmap for your IT future, you get investment protection through programs like in-chassis upgrades to Intel's next generation of Itanium processors, offering you tremendous growth potential.

# Adaptable, available: the HP Integrity rx7620-16 and rx8620-32 Servers

## Introduction

Today's HP Integrity servers outpace competitive servers by providing more compute power, more applications, additional features, and a broader range of solutions across both commercial and technical computing. The HP Integrity server family offers hardware and software solutions for every tier of the enterprise, from entry-level to high-end enterprise computing, featuring the Integrity rx2600-4, rx4640-8, rx7620-16, and rx8620-32 Servers and the Integrity Superdome. This paper covers the Integrity rx7620-16 and rx8620-32 midrange servers—two highly flexible and scalable members of the HP Integrity server family, powered by the revolutionary Intel Itanium 2 processor. These systems may be configured with either traditional Intel Itanium 2 processors or with HP mx2 Dual-Processor Modules consisting of two Intel Itanium 2 processors. When configured with traditional Intel Itanium 2 processors, the Integrity rx7620-16 Server has a capacity of 8 processors while the Integrity rx8620-32 Server has a capacity of 16 processors. When configured with HP mx2 Dual-Processor Modules, the Integrity rx7620-16 Server has a capacity of 16 processors, while the Integrity rx8620-32 Server has a capacity of 32 processors.

The Integrity rx7620-16 and rx8620-32 Servers give you the performance and financial flexibility to power every application, from Web serving to mission-critical enterprise resource management, as well as world-leading performance, operating environment flexibility, and simplified management, for a level of functionality and value unmatched in their class.

This white paper introduces you to the technical details of both the Integrity rx7620-16 and rx8620-32 Servers, beginning by describing their modular designs, system architectures (including the HP Super-Scalable Processor Chipset sx1000), cell board design and configurations, and I/O subsystems. Every aspect of the operation and design of the Integrity rx7620-16 and rx8620-32 Servers is covered, including performance and scalability, unit racking, partitioning, manageability, serviceability, and high-availability features.

Note regarding processor naming: In this paper, the current 1.6 and 1.5 GHz Intel Itanium processors will be referred to as Intel Itanium 2 processors or "traditional" Intel Itanium 2 processors. HP mx2 Dual-Processor Modules (which consist of two Intel Itanium 2 processors) will be referred to as HP mx2 Dual-Processor Modules.

Note regarding server naming: The HP Integrity midrange servers announced in 2003 (Integrity rx7620 and rx8620 Servers) have been renamed to reflect the maximum number of processors to which they can scale. Since the HP mx2 Dual-Processor Module increases the scalability of these servers, this number reflects the maximum server CPU capacity, assuming HP mx2 Dual-Processor Modules are used. Thus, the Integrity rx7620 Server has been renamed the Integrity rx7620-16 Server and the Integrity rx8620 Server has been renamed the Integrity rx8620-32 Server.

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**Figure 1.** HP Integrity rx7620-16 and rx8620-32 Servers



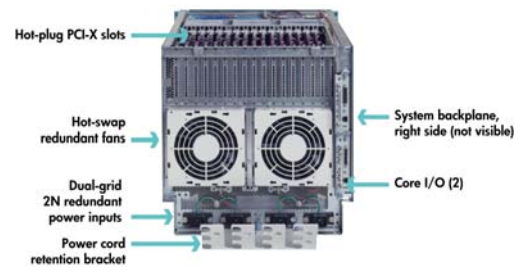
# HP Integrity rx7620-16 and rx8620-32 Server specifications

	HP Integrity rx7620-16 Server with 8-way Intel Itanium 2 processor or 16-way HP mx2 Dual-Processor Module	HP Integrity rx8620-32 Server with 16-way Intel Itanium 2 processor or 32-way HP mx2 Dual-Processor Module	HP Integrity rx8620-32 Server Expansion Unit (SEU)
Cell boards	1–2	1–4	
1.5 or 1.6 GHz Intel Itanium 2 processors	2–8	2–16	
1.1 GHz Dual-Processor Module	1–8 Dual-Processor Modules (2-way–16-way)	1–16 Dual-Processor Modules (2-way–32-way)	
Memory (with 512 MB, 1 GB, 2, or 4 GB DIMMs)	2–128 GB	2–256 GB	
Hot-plug PCI-X I/O slots	15 slots	16 slots	16 slots
Aggregate I/O slot bandwidth	15.4 GB/s	15.9 GB/s	15.9 GB/s
PCI-X slot single bus bandwidth (qty.)	533 MB/s (1)	533 MB/s (2)	533 MB/s (2)
PCI-X slot dual bus bandwidth (qty.)	1066 MB/s (14)	1066 MB/s (14)	1066 MB/s (14)
Internal disk storage slots/ max. capacity	4/584 GB	4/584 GB	4/584 GB
Internal removable media slots (DVD, DAT)	1	2	2
Hard partitions	2	2 (4 with Server Expansion Unit)	
Hot-swap redundant power supplies (N+1 included)	2	6	2
Hot-swap redundant fans (N+1 included)	Yes	Yes	Yes
High-availability features	Hot-swap redundant fans and bulk power supplies Redundant power line inputs for dual grid protection Error checking and correcting (ECC) on all CPU and memory paths Main memory DRAM kill resiliency (chip spare) Parity-protected I/O data paths		
Operating system	Intel Itanium 2 processors: HP-UX 11i v2, Windows Server 2003 Enterprise and Datacenter editions, Red Hat Linux v3.0, OpenVMS (2005) HP mx2 Dual-Processor Module: HP-UX 11i v2, Windows Server 2003 Enterprise and Datacenter editions, OpenVMS (2005)		
<b>Dimensions:</b>			
Height—Rack	445 mm (17.5 in.)	755 mm (29.7 in.)	400 mm (15.75 in.)
—Pedestal	527 mm (20.75 in.)	833 mm (32.8 in.)	
Width	482 mm (19.0 in.)	482 mm (19.0 in.)	482 mm (19.0 in.)
Depth	762 mm (30.0 in.)	762 mm (30.0 in.)	762 mm (30.0 in.)
Typical power consumption for maximum configuration	2030 VA	3800 VA	662 VA
Weight (max.)	99.8 kg (220 lb.)	171.4 kg (378 lb.)	81.6 kg (180 lb.)

**Figure 2.** Front and side view of the Integrity rx7620-16 Server



**Figure 3.** Rear view of the Integrity rx7620-16 Server



Figures 2 and 3 show major components of the HP Integrity rx7620-16 Server, as well as the system’s mechanical and architectural features. Figure 2 shows the Integrity rx7620-16 Server with its front plastic bezel and top and left side panels removed.

A peripheral bay located at the top front of the Integrity rx7620-16 Server provides space for four hot-plug disk drives and one removable-media device (DVD or DAT). Directly below the peripheral bay are two PCI-X power bricks, which supply DC power for the PCI-X backplane. Below the power supplies are two redundant hot-swappable cooling fans. These fans pull cool air in from the front and force air to the rear, cooling the system’s internal components. At the bottom is the bulk power supply (BPS) bay, which houses two redundant (2N) hot-swap power supplies with dual grid support.

The illustration also shows the right side of the Integrity rx7620-16 Server, with a view of the cell board bay, which supports up to two cell boards. The cell boards contain processors, memory, and cell controller chips.

Figure 3 is a rear view of the Integrity rx7620-16 Server showing the location of the two hot-swappable 150 mm exhaust fans and the I/O bay bulkhead directly above them. The core I/O cards are located at the right edge of the unit.

The system backplane board houses the linkages used for communications between cell boards, I/O, and internal peripherals. The Integrity rx7620-16 Server’s I/O card bay is located at the top rear of the system. It contains 15 PCI-X card slots, all supporting hot-plug functionality.

The bottom rear of the Integrity rx7620-16 Server has inputs for the 2+2 redundant line cords. Because of the high degree of connectivity offered in the Integrity rx7620-16 Server, a cable management arm (not shown) is provided in racked systems for dressing cables and simplifying cable routing (available only on racked systems).

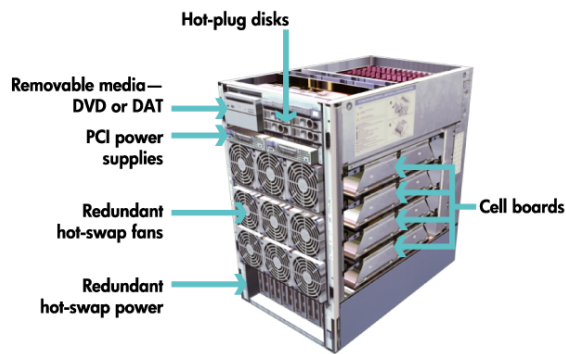
The Integrity rx7620-16 and rx8620-32 Servers share many system components and design features. The similarities are evident in Figures 4 and 5, which show the major components and architectural features of the Integrity rx8620-32 Server.

Figure 4 shows a front view of the Integrity rx8620-32 Server with its front plastic bezel and top and left side panels removed.

A peripheral bay located at the top front of the Integrity rx8620-32 Server provides space for four hot-plug disk drives and two removable-media devices (DVD or DAT). Directly below the peripheral bay are two PCI-X power bricks, which supply DC power for the PCI-X backplane. Below the power supplies are nine redundant hot-swappable cooling fans. These fans pull cool air in from the front and force air to the rear, cooling the system's internal components. At the bottom is the bulk power supply bay, which houses up to six redundant (2N+1) hot-swap power supplies.

The figure also shows the side of the Integrity rx8620-32 Server, with a view of the cell card cage. This cage supports up to four cell boards that processors, memory, and cell controller chips reside on.

**Figure 4.** Front and side view of the Integrity rx8620-32 Server



**Figure 5.** Rear view of the Integrity rx8620-32 Server

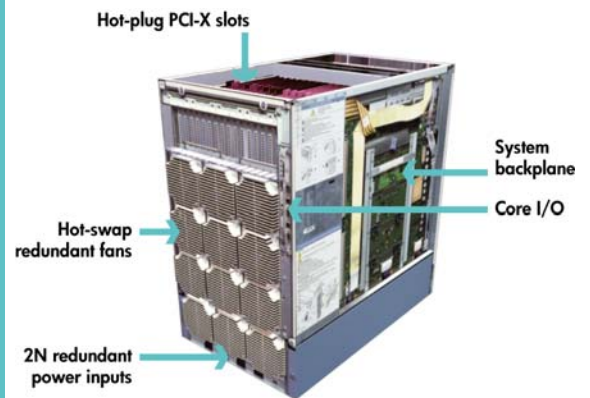


Figure 5 is a rear view of the Integrity rx8620-32 Server showing the location of the 12 hot-swappable 120 mm exhaust fans and the I/O bay bulkhead directly above them. The core I/O cards are located at the right edge of the unit.

Visible here is the system backplane board, which houses the high-bandwidth crossbar used for communications between cell cards, I/O, and internal peripherals. The Integrity rx8620-32 Server's I/O card bay is located at the top rear of the system. It contains 16 PCI-X card slots, all supporting hot-plug functionality.

The bottom rear of the Integrity rx8620-32 Server has inputs for the 2+2 redundant line cords. Because of the high degree of connectivity offered in the Integrity rx8620-32 Server, a cable management arm is provided for dressing cables and simplifying cable routing. (The cable management arm is not shown here and is available only on Integrity rx8620-32 Server racked systems.)



## System architecture

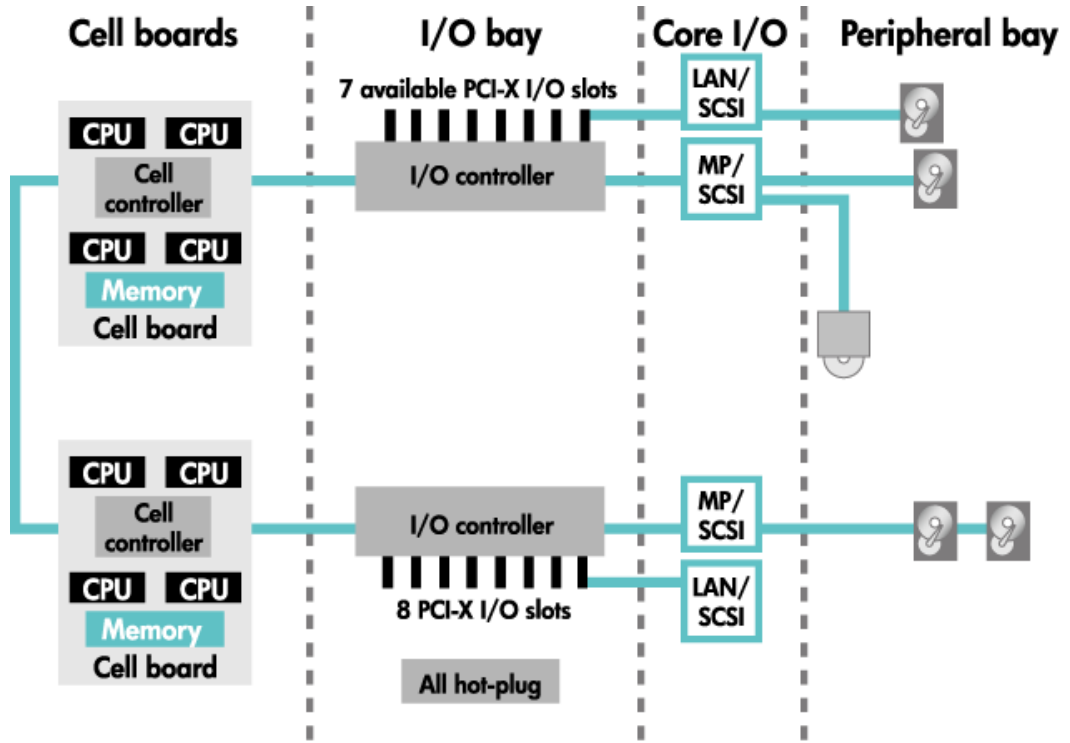
HP Integrity midrange servers are built around a modular architecture, with components that can be configured to effectively cover a wide range of computing needs. Both the Integrity rx7620-16 and 8620-32 Servers support a variety of system configurations, ranging from two to eight 1.6 or 1.5 GHz Intel Itanium 2 processors or from two to 16 1.1 GHz Intel Itanium 2 processors, using HP mx2 Dual-Processor Modules. Both servers can be configured as large symmetric multiprocessing (SMP) systems or as multiple independent hard partitions (nPars). The basic components in the HP Integrity midrange servers are the cell board, the PCI-X-based I/O subsystem, and, in the Integrity rx8620-32 Server, the crossbar backplane. These components fit together to provide a high-performance, scalable, highly available, and flexible computing platform.

The HP mx2 Dual-Processor Module allows the Integrity rx7620-16 and rx8620-32 Servers' chassis to be expanded to allow 16 processors and 32 processors, respectively, in the existing chassis. The HP mx2 Dual-Processor Module consists of two Intel Itanium 2 1.1 GHz processors joined by a daughterboard. This new technology allows two microprocessors to occupy the same space as a single processor. For example, a typical cell board contains four processor sockets, but with the HP mx2 Dual-Processor Module, the same cell board can contain eight processors, resulting in double the capacity of the system in the same chassis. The performance of the HP mx2 Dual-Processor Module is enhanced with a 4 MB L3 cache, along with a 32 MB L4 cache.

### HP Integrity rx7620-16 Server architecture

The HP Integrity rx7620-16 Server architecture is designed around the ability to operate the system as a single 2- to 8-way (Intel Itanium 2 processor) or 2- to 16-way (HP mx2 Dual-Processor Module) SMP server or to divide it into two independent hard partitions (nPars). Figure 6 shows the primary components of the Integrity rx7620-16 Server architecture. When the system is configured as a non-partitioned server, all resources shown in Figure 6 are available to perform together as one logical server. When it is configured as two nPars, system resources are divided into two logical servers, or independent partitions, each containing a cell board with a dedicated set of I/O resources. For example, in Figure 6, imagine that the solid line connecting the upper and lower cell boards is no longer there. The drawing would then reflect a system divided into two independent partitions. The cell board, I/O bay, core I/O, and peripheral bay in the upper half of the drawing would be an independent hard partition, which is isolated from the second partition shown in the lower half of the drawing.

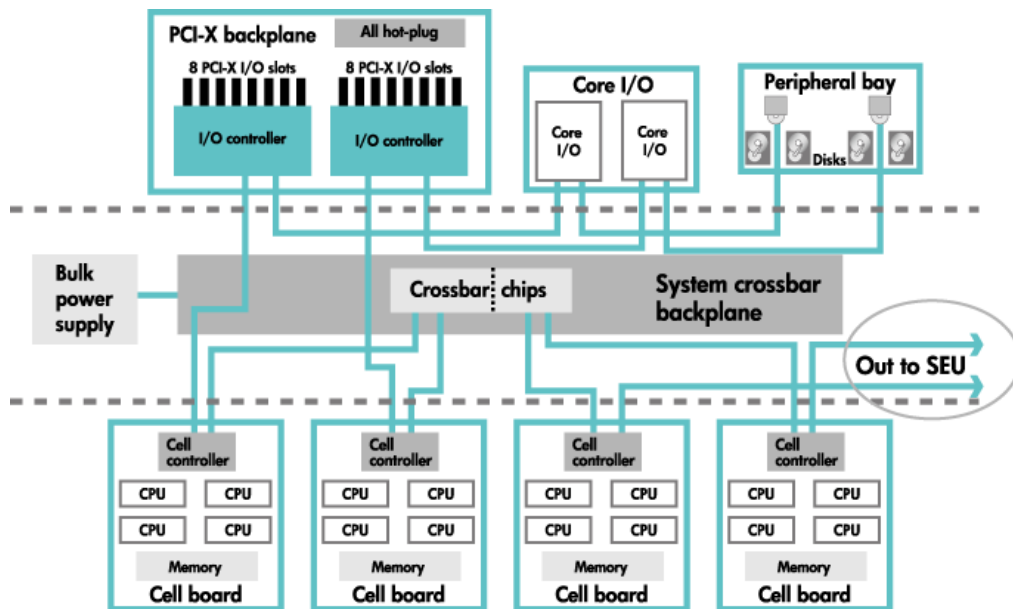
Figure 6. Architecture of the HP Integrity rx7620-16 Server, showing the basic modular building blocks of the system



## HP Integrity rx8620-32 Server architecture

The HP Integrity rx8620-32 Server architecture builds upon that of the Integrity rx7620-16 Server with the addition of a crossbar backplane and two more cell boards. The crossbar backplane provides a non-blocking connection between up to four cells, plus connection to the external I/O resources in the HP Server Expansion Unit (SEU). Similarly to the Integrity rx7620-16 Server, the Integrity rx8620-32 Server can be configured as one 2- to 16-way (Intel Itanium 2 processor) or 2- to 32-way (HP mx2 Dual-Processor Module) SMP server, or it can be divided into smaller independent nPars. The Integrity rx8620-32 Server can be divided into four hardware-isolated partitions when connected to the SEU.

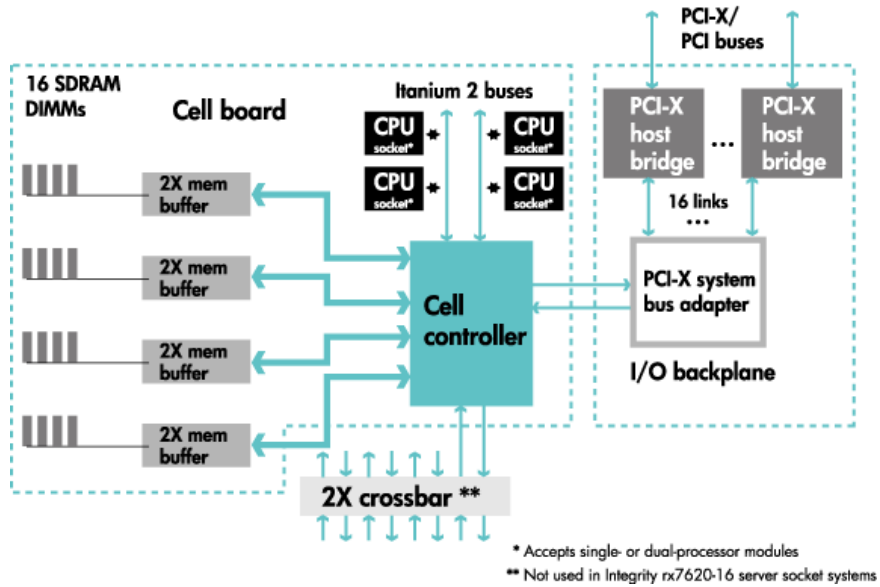
**Figure 7.** Architecture of the HP Integrity rx8620-32 Server, showing the basic modular building blocks of the system and the buses that connect them



## HP Super-Scalable Processor Chipset sx1000

To support the growing needs in performance, scalability, and functionality, HP has developed the new HP Super-Scalable Processor Chipset sx1000. The HP sx1000 Chipset consists of five distinct ASICs: the cell controller, memory controller, system bus adapter, PCI-X host bridge adapter, and crossbar. The HP sx1000 Chipset provides connectivity to Intel Itanium 2 processors, HP mx2 Dual-Processor Modules, PA-8800 Processors, and future Intel Itanium and PA-RISC processors. In addition, the HP sx1000 Chipset provides higher CPU and memory bandwidth, faster low-level error correction than the previous chipset, and PCI-X support.

Figure 8. Primary components of the HP sx1000 Chipset



## Cell boards

The cell, or cell board, is one of the basic building blocks of the HP Integrity rx7620-16 and rx8620-32 Servers. A cell board is a module that primarily houses processors, memory, and the cell controller ASICs.

Figure 9. Layout of the Integrity rx7620-16/rx8620-32 Server cell board.



## Cell design details

Each cell board is a self-contained unit, with a symmetric multiprocessor (SMP), main memory, and all necessary hardware.

- CPUs—up to four 1.6/1.5 GHz Intel Itanium 2 processors or four 1.1 GHz HP mx2 Dual-Processor Modules (consisting of eight Intel Itanium 2 processors)
- Cell controller ASIC
- Memory controller (buffer) ASIC
- Main memory DIMMs (up to 16 DIMMs per cell board)
- Voltage regulator modules (VRMs)
- Data buses

The cell controller ASIC (CC) is at the heart of each cell board. The CC provides the communications link between processors, memory, I/O, processor-dependent hardware (PDH), and adjacent cells. The cell controller chip contains interface logic and maintains cache coherency throughout the system. Adjacent to the cell controller ASIC are up to four Intel Itanium 2 processors or HP mx2 Dual-Processor Modules and up to 64 GB of main memory. Each cell interfaces with adjacent cells and I/O resources either directly or, in the case of the Integrity rx8620-32 Server, through the crossbar backplane.

The primary function of the memory controller ASIC is to multiplex and de-multiplex data between the cell controller ASIC and the SDRAM in the memory subsystem. When the cell controller ASIC issues a read transaction to the memory interface command bus, the memory controller ASIC buffers the DRAM read data and returns it as soon as possible. When the cell controller issues a write transaction, the memory controller ASIC receives the write data from the cell controller ASIC and forwards it to the DRAMs.

Note that only the data portion of the memory subsystem goes through the memory controller ASIC. All address and control signals to the DIMMs are generated by the cell controller ASIC and sent directly to the DIMM via the memory interface address bus.

The memory subsystem is a quad-ported implementation. It supports memory DRAM fault tolerance, in which a discrete SDRAM chip can fail without compromising data integrity. The memory subsystem provides 16 GB/s of peak bandwidth to the cell controller ASIC and reduces the overhead typically associated with directory coherency.

## Cell configurations

The Integrity rx7620-16 Server supports a minimum of one and a maximum of two cells. The Integrity rx8620-32 Server supports a minimum of one and a maximum of four cells. When configured with Intel Itanium 2 processors, each cell can be purchased with two or four active Intel Itanium 2 processors or HP mx2 Dual-Processor Modules. When configured with HP mx2 Dual-Processor Modules, each cell can be purchased with one, two, three, or four active processor modules (providing two, four, six, or eight total Intel Itanium 2 processors). The fully loaded Integrity rx7620-16 Server will therefore contain eight Itanium 2 processors or eight HP mx2 Dual-Processor Modules (16 CPUs). The fully loaded Integrity rx8620-32 Server will therefore contain 16 Itanium 2 processors or 16 HP mx2 Dual-Processor Modules (32 CPUs). They may also be purchased in combination with inactive Instant Capacity processors.

Both systems support traditional Intel Itanium 2 processors in two speeds: 1.6 GHz with 6 MB of cache or 1.5 GHz with 4 MB of cache. They also support HP mx2 Dual-Processor Modules in one speed: 1.1 GHz with 4 MB of L3 cache and 32 MB of L4 cache. The ability to mix processor speeds within a chassis is supported, but processors within a cell or partition must be the same speed. In addition, the ability to mix CPU types (between traditional Intel Itanium 2 processors and HP mx2 Dual-Processor Modules) is also supported, but processors within a cell or partition must be the same type.

Within the cell, CPU-to-CC peak bandwidth is 12.8 GB/s, a greater than 50% improvement over previous-generation systems.

The minimum supported cell configuration is two active processors and 2 GB of memory per cell board. The maximum configuration includes eight active processors and 64 GB memory per cell board in the Integrity rx7620-16 Server; the Integrity rx8620-32 Server supports a maximum of 16 active processors and 64 GB memory per cell board. Memory DIMM modules are sold in sets of four (quads), with available DIMM sizes of 512 MB, 1 GB, 2 GB, and 4 GB. Memory quads of different sizes can be mixed within a chassis and within a cell. However, for optimum memory interleaving and performance, it is recommended that one memory size be selected, distributed evenly across available cells, and loaded in increments of eight DIMMs (two quads).

Within a cell, the CC-to-memory peak bandwidth is 16 GB/s, a 4X improvement compared to earlier releases. Memory is accessed directly through the CC, so all memory slots are accessed regardless of the number of processors loaded on the cell.

### Memory latency

There are two types of memory latency within the HP Integrity rx7620-16 Server:

- **Memory latency within the cell** refers to the case where an application either runs on a partition that consists of a single cell or uses cell local memory.
- **Memory latency between cells** refers to the case where the partition consists of two cells and cell interleaved memory is used. In this case, 50% of the addresses are to memory on the same cell as the requesting processor, and the other 50% of the addresses are to memory on the other cell.

The HP Integrity rx7620-16 Server average memory latency depends on the number of processors in the partition. Assuming that memory accesses are equally distributed across all cell boards and memory controllers within the partition, the average idle memory latency (load-to-use) is as shown here:

Number of processors per partition	Average memory latency
4 processors (one cell)	~241 ns
8 processors (two cells)	~292 ns

There are two types of memory latency within the HP Integrity rx8620-32 Server:

- **Memory latency within the cell** refers to the case where an application either runs on a partition that consists of a single cell or uses cell local memory.
- **Memory latency between cells** refers to the case where the partition consists of two or more cells and cell interleaved memory is used. For example, for an Integrity rx8620-32 Server with four cells in the partition, 25% of the addresses are to memory on the same cell as the requesting processor, and the other 75% of the addresses are to memory on the other three cells.

The HP Integrity rx8620-32 Server's average memory latency depends on the number of CPUs in the partition. Assuming that memory accesses are equally distributed across all cell boards and memory controllers within the partition, the average idle memory latency (load-to-use) is as shown here:

Number of processors per partition	Average memory latency
4 processors (one cell)	~241 ns
8 processors (two cells)	~324 ns
12 processors (three cells)	~352 ns
16 processors (four cells)	~366 ns

## Cell hot-plug

The HP Integrity rx7620-16 and rx8620-32 Servers support cell hot-plug. Coupled with the servers' partitioning capability<sup>1</sup>, cell hot-plug allows for the servicing of cell boards within a single partition while the other partition continues normal operation. Any number of configuration changes can be made to the partition being serviced, including replacing the complete cell board, adding or deleting CPUs and memory, or even increasing or decreasing the number of cells in that partition. (Cell hot-plug is supported only in systems with two or more partitions.)

## Crossbar backplane

The next basic building block of the Integrity rx8620-32 Server is the crossbar backplane. The crossbar backplane contains two crossbar chips that provide a non-blocking connection between four cells and their associated memory and I/O. (The Integrity rx7620-16 Server does not have a crossbar backplane, so communication between its cells is over a direct-connect bus.)

### Crossbar chips

The crossbar ASIC is yet another part of the HP sx1000 Chipset. The Integrity rx8620-32 Server crossbar consists of two chips. Each chip implements a high-performance 8-port non-blocking crossbar and the 500 MHz crossbar link protocol. Together, the two crossbar chips provide 16 high-performance ports for cell-to-cell communication, with 8 GB/s of bandwidth available for each cell. All ports are functionally and electrically identical. Some of the features of the crossbar chip that contribute to performance include the following:

- Support for scaling up to a 128-way coherent shared memory system
- 250 MHz speed of operation
- 500 MT/s (mega transfers/second) link speed
- Support for two interleaved channels on link protocol
- Support for double-length data packets for Intel Itanium Processor Family mode
- Performance counters to enable software tuning

The crossbar mesh implements a global point-to-point packet filtering network. This mesh features an extremely high level of integrity, with each crossbar port operating independently. The crossbar mesh has dedicated paths for data and control. Each port can be reset, assigned, or reconfigured fully independent of other ports. The crossbar mesh of the HP Integrity rx8620-32 Server is an excellent foundation for resource isolation.

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<sup>1</sup> The Integrity rx8620-32 server can be configured as a single large SMP server or hardware-partitioned into up to four smaller logical servers. See "nPartitions" for more details about partitioning.

## I/O subsystem

Each HP Integrity rx7620-16 and rx8620-32 Server contains an embedded high-performance I/O subsystem. In addition, the Integrity rx8620-32 Server can optionally connect to external I/O resources located in the HP SEU through a high-performance I/O cable link. The components within the I/O subsystem are the I/O controllers, internal peripheral bay, and multifunction core I/O. Basic block diagrams for the HP Integrity rx7620-16 and rx8620-32 Server I/O subsystems are shown in Figures 10 and 11.

Figure 10. Basic block diagram of the Integrity rx7620-16 Server I/O subsystem

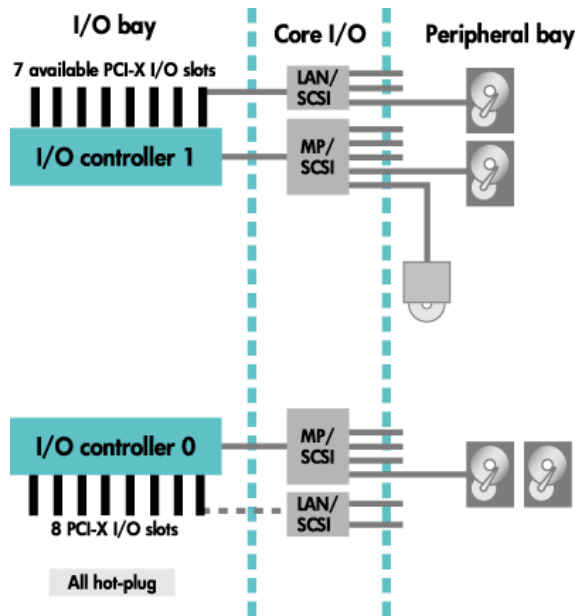
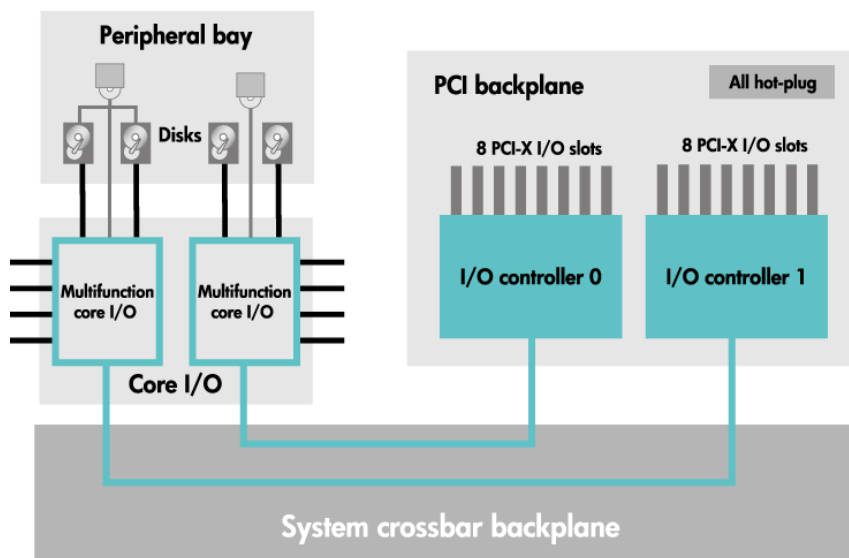


Figure 11. Basic block diagram of the Integrity rx8620-32 Server I/O subsystem





### **I/O controller chips**

The HP Integrity rx7620-16 and rx8620-32 Servers contain two master I/O controller chips located on the PCI-X backplane. Each I/O controller contains 16 high-performance, 12-bit-wide links. These links connect to 16 slave I/O controller chips supporting the PCI-X card slots and core I/O.

In both systems, two links—one from each master controller—are routed through the system backplane and are dedicated to core I/O. The remaining 30 links are divided among the 16 133 MHz × 64-bit PCI-X card slots, with each slot on a dedicated PCI-X bus. This one-card-per-bus architecture leads to greater I/O performance, better error containment, and higher availability.

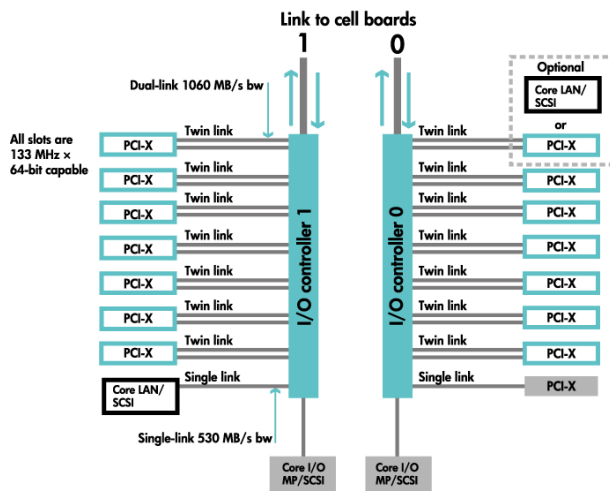
Each controller chip is also directly linked to a host cell board. This means that two cell boards, located in cell slots 0 and 1, must be purchased in order to access all available I/O card slots. (With one cell board, access to half of the available slots is enabled.)

### **PCI-X backplane**

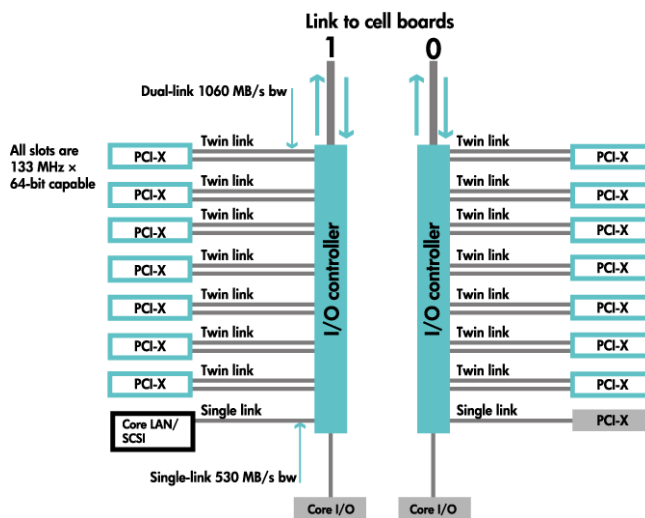
Figures 12 and 13 show detailed views of the HP Integrity rx7620-16 and rx8620-32 Server PCI-X backplanes. The I/O slot implementations between the two servers are almost identical—the difference is the use of one or two slots by the Integrity rx7620-16 Server core I/O. In both figures, note that 14 of the 16 I/O card slots are supported by dual high-performance links. These dual-link I/O slots provide a maximum of 1.06 GB/s of peak bandwidth for the slot. The remaining two I/O slots are single links and provide a maximum of 530 MB/s of peak bandwidth. Aggregate I/O slot bandwidth is 15.9 GB/s.

Every PCI-X slot in the HP Integrity rx7620-16 and rx8620-32 Servers is capable of running at 133 MHz × 64 bits. This means that every I/O slot will allow the industry's highest-performing PCI-X cards to run at their maximum design speed.

**Figure 12.** The PCI-X backplane of the Integrity rx7620-16 Server has dual high-performance links for 14 of the 16 I/O card slots



**Figure 13.** The PCI-X backplane of the Integrity rx8620-32 Server has dual high-performance links for 14 of the 16 I/O card slots



In practice, PCI-X I/O cards requiring the largest amount of bandwidth should be configured into the dual-link slots. Because each I/O slot has a dedicated bus, any slot can be hot-plugged or serviced without affecting other slots.

## Core I/O

The HP Integrity rx7620-16 and rx8620-32 Servers are purchased with either one or two core I/O card products. In both systems, core I/O provides console, Ultra160 SCSI, Gigabit LAN, serial, and Management Processor (MP) functionality, along with SCSI controllers for the peripheral bay. The second core I/O product can be used to enable dual partitioning, provide access to a second set of disk drives, and provide redundant MP functionality. In the HP Integrity rx8620-32 Server, the second core I/O product also enables the use of an additional removable-media device. Although core I/O provides the same functionality in both the HP Integrity rx7620-16 and rx8620-32 Servers, the physical implementation is different. To accommodate size limitations, the core I/O in the Integrity rx7620-16 Server is divided across two separate boards, while the core I/O in the Integrity rx8620-32 Server is implemented on one physical board. The following sections detail the core I/O implementation in each system.

### HP Integrity rx7620-16 Server core I/O

The Integrity rx7620-16 Server chassis supports up to two core I/O card sets. Each set contains two cards (MP/SCSI and LAN/SCSI), which are installed in different locations: MP/SCSI cards are installed along the right rear vertical edge of the chassis; LAN/SCSI cards are installed in the PCI-X card bay. A minimum of one core I/O card set must be ordered with each system; the optional second core I/O card set can be used to enable hardware partitioning or to utilize the full capacity of the built-in mass storage bays.

Both core I/O card sets are identical. However, the electrical connections to internal peripherals and the I/O controller are slightly different. In the primary core I/O set, the LAN/SCSI board is supported by a single 530 MB/s link; in the secondary core I/O set, the LAN/SCSI board is supported by two 530 MB/s links. In addition, in the primary core I/O set, the two SCSI controllers—one in the LAN/SCSI card and one in the MP/SCSI card—each support a single internal disk drive. In the secondary core I/O, only the MP/SCSI board is used to support disk drives. However, both disk drives are supported from this single SCSI controller and bus.

**Figure 14.** Block diagram showing basic core I/O card set (primary) in the Integrity rx7620-16 Server

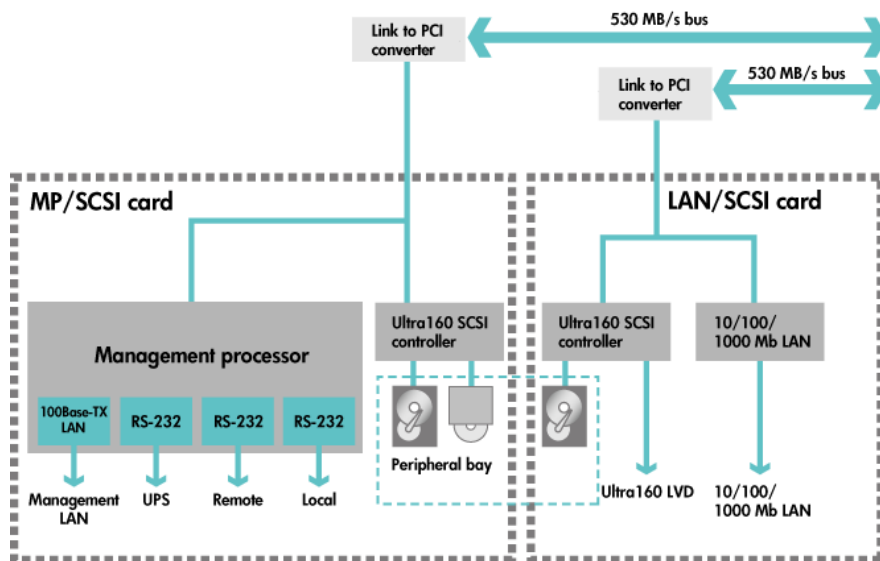
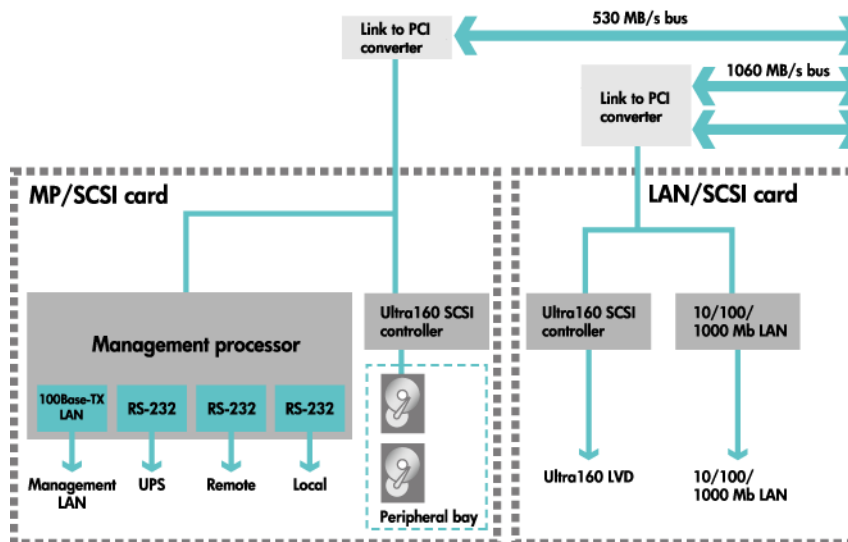


Figure 15. Basic core I/O card set (secondary)



**The Management Processor**—The Management Processor (MP) is a dedicated processor located on each MP/SCSI card that simplifies and extends system management and enhances serviceability. The MP reduces or eliminates the need for the system administrator to be physically at the system to perform tasks such as diagnostics, system management, or even hard resets. Following are some of the features offered by the Integrity rx7620-16 and rx8620-32 Server Management Processor:

- System management over the Internet or intranet
- System console redirection
- Console mirroring
- System configuration for automatic restart
- Viewing history log of system events
- Viewing history log of console activity
- Setting MP inactivity timeout thresholds
- Remote system control
- Remote power cycle (except for MP housekeeping power)
- Viewing system status
- Event notification to system console, e-mail, pager, and/or HP Response Centers (e-mail and pager notification work in conjunction with HP Event Monitoring Service [EMS])
- Automatic hardware protection of critical environmental problems
- Access to management interface and consoles on WAN failure (modem required)
- Automatic system restart
- Remote resetting of hardware partitions
- Forward progress indicator (via a virtual front panel)
- Out-of-band manageability and processor-dependent code (PDC) firmware update
- Configuration of manageability and console security
- MP failover (systems with both core I/O boards)
- Secure Sockets Layer (SSL)

**External LAN**—The external LAN port is a 10/100/1000Base-T external LAN port that uses an RJ-45 connector.

**External SCSI**—The external SCSI port is an Ultra160 LVD external SCSI port for connections to mass storage or media.

### HP Integrity rx7620-16 Server internal peripheral bay

The Integrity rx7620-16 Server internal peripheral bay is located at the top front of the system chassis. The peripheral bay holds up to four low-profile hot-plug disks and one removable media device (either DVD or DAT).

Each Integrity rx7620-16 Server core I/O card set contains dual-channel Ultra160 SCSI controller chips that support the SCSI devices in the internal peripheral bay. Each core I/O card set supports two internal disks. It is important to note that separate controllers and SCSI buses manage the two disks supported by the primary core I/O card set. A single controller and SCSI bus manage the second pair of disks supported by the secondary core I/O card set. If use of more than two internal disks is needed, the Integrity rx7620-16 Server will require both core I/O card sets.

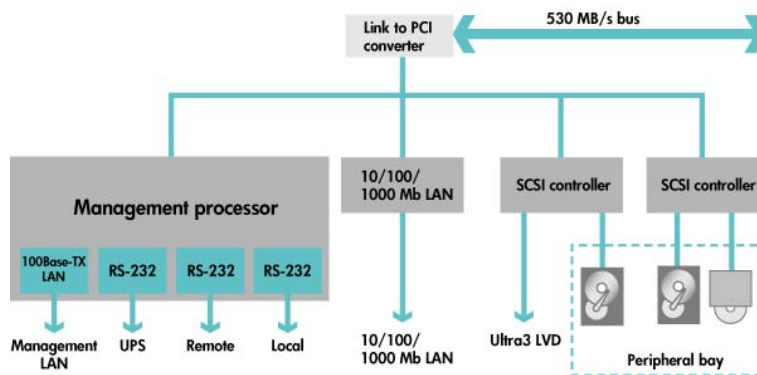
**Internal disks**—The Integrity rx7620-16 Server holds up to four SCSI disks, which are accessible from the front of the server. These are hot-plug disks, so they can be removed and inserted while the Integrity rx7620-16 Server continues to operate. The system supports the following disks: 36 GB, 15K rpm; 73 GB, 15K rpm; and 146 GB, 10K rpm.

**Removable media**—The Integrity rx7620-16 Server contains one removable-media bay, which supports either a DVD drive or a DDS-4 DAT drive. Access to these devices is also from the front. The DVD drive provides enhanced features while preserving backward read compatibility with CD-ROM drives. Data transfer rates of up to 6.75 MB/s are achieved with the DVD format; 4.8 MB/s can be achieved using the CD-R format. The DDS-4 drive has a maximum storage capacity of 40 GB, with a peak transfer rate of 21.6 GB/hour (compressed).

### HP Integrity rx8620-32 Server core I/O

The Integrity rx8620-32 Server chassis supports up to two core I/O cards, installed in core I/O slots located along the right-rear vertical edge of the chassis. A minimum of one core I/O card must be ordered with each system; the optional second core I/O card can be used to enable hardware partitioning or to utilize the full capacity of the built-in mass storage bays.

**Figure 16.** Block diagram showing the basic core I/O in the Integrity rx8620-32 Server



The core I/O Management Processor, external LAN port, and external SCSI port functionality in the HP Integrity rx8620-32 Server is the same as described above in the Integrity rx7620-16 Server core I/O section. However, there are slot count and bus routing differences in the peripheral bay implementation. The following section pertains specifically to the Integrity rx8620-32 Server peripheral bay.

**Access to internal peripheral bay**—The first core I/O card enables half of the Integrity rx8620-32 Server peripheral bay, which includes one removable-media device and two low-profile disks. The second core I/O card enables the remaining internal peripherals, two disks, and one removable-media bay. Customers who require access to more than two internal disks or more than one removable-media slot will need the second core I/O card and a minimum of two cell boards.

### **HP Integrity rx8620-32 Server internal peripheral bay**

The Integrity rx8620-32 Server internal peripheral bay is located at the top front of the system chassis. The peripheral bay holds up to four low-profile hot-plug disks and two removable-media devices.

Each Integrity rx8620-32 Server core I/O card contains two dual-channel SCSI controller chips that support the SCSI devices in the internal peripheral bay. Each core I/O card supports two internal disks and one removable-media device, each on a dedicated 40 MB/s SCSI channel. If use of more than two internal disks or one removable-media device is needed, the Integrity rx8620-32 Server will require both core I/O cards. This architecture also provides an added degree of availability by supporting full disk mirroring across independent buses, controllers, core I/O cards, and master I/O controller chips.

**Hot-plug disk drives**—The Integrity rx8620-32 Server holds up to four SCSI disks, which are accessible from the front of the server. These are hot-plug disks, so they can be removed and inserted while the Integrity rx8620-32 Server continues to operate. Three disk sizes are currently supported: 36 GB, 15K rpm; 73 GB, 15K rpm; and 146 GB, 10K rpm.

**Removable-media bays**—The Integrity rx8620-32 Server contains two removable-media bays, which support either a DVD drive or DDS-4 DAT drive. Access to these devices is also from the front of the server. The DVD drive provides enhanced features while preserving backward read compatibility with CD-ROM drives. Data transfer rates of up to 6.75 MB/s are achieved with the DVD format; 4.8 MB/s can be achieved using the CD-R format. The DDS-4 drive has a maximum storage capacity of 40 GB, with a peak transfer rate of 21.6 GB/hour (compressed).

## HP Server Expansion Unit

The HP Server Expansion Unit (SEU) is an add-on chassis containing I/O resources that complement the I/O and partitioning capabilities within the HP Integrity rx8620-32 Server. The Integrity rx8620-32 Server contains built-in ability to connect to the HP SEU. Connection to the SEU doubles the amount of Integrity rx8620-32 Server I/O resources, and the SEU enables the creation of two additional nPars within the chassis. The following features are provided by the SEU:

- 16 high-performance PCI-X I/O slots
- All slots 133 MHz × 64 bit capable
- All slots support hot-plug
- All slots supported by independent dual or single links
- Four disk drive bays
- Two removable media slots (either DVD or DAT)
- Two additional nPars in the Integrity rx8620-16 and rx8620-32 Server host are enabled
- Two core I/O slots
- Redundant and hot-swappable fans and bulk power supplies
- Redundant line cords for dual grid support

- 9U rackmount chassis
  - Certified under Uptime Institute's Fault Tolerant Power Compliance Specification
- 

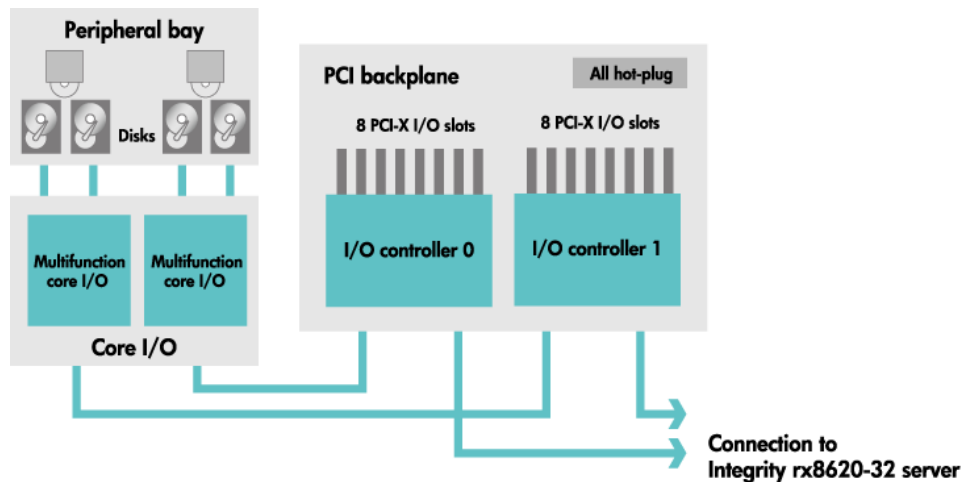
**Figure 17.** The HP SEU (left) and the SEU + HP Integrity rx8620-32 Server mounted in HP 2-meter cabinet (right)



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The HP SEU mirrors the I/O resources embedded within the Integrity rx8620-32 Server chassis, both physically and electrically. The high-speed connection between the Integrity rx8620-32 Server and the SEU is provided through a remote I/O (RIO) cable with 4 GB/s bandwidth. The RIO cable mounts directly to the system backplane board in the Integrity rx8620-32 Server and to the I/O backplane board in the SEU.

Figure 18. The HP SEU block diagram



## AC power subsystem

The HP Integrity rx7620-16 and rx8620-32 Servers were both designed to take full advantage of the multi-grid power inputs found in today's high-end data centers. This means that both servers can connect to two independent power grids at the same time and are able to tolerate a grid failure without causing computing interruptions. The power subsystems are so robust that they both are certified (without deviations) under the Uptime Institute's Fault Tolerant Power Compliance Specification. The specific AC power subsystem details are covered separately in the following section.

### Fault-tolerant power compliance in the Integrity rx7620-16 Server

The AC input to the Integrity rx7620-16 Server is divided into four separate circuits. Each circuit is fed by any 50 to 60 Hz high line source through four line cords. ("High line" refers to 200–240 volts.) A minimum of two power cords is used to maintain normal operation of the Integrity rx7620-16 Server. A second set of two cords is added to improve system availability by protecting, for example, against power grid failures, failed power supplies, or accidentally tripped circuit breakers. Four power cords are used in order to enable redundancy and hot-swap functionality of the bulk power supplies. This power is routed from four individual 20-ampere circuit breakers via input line filters to two internal bulk power supplies (BPSs). These four lines are labeled A0, B0, A1, and B1 at the line filter inputs on the back panel of the Integrity rx7620-16 Server.

Figure 19 shows the Integrity rx7620-16 Server power configuration. Note that each AC inlet feeds one Integrity rx7620-16 Server bulk power supply (BPS) and those two separate AC inlets feed each bulk supply. The design of the individual BPSs and the configuration of the interconnect meet all the conditions for fault-tolerant power compliance.

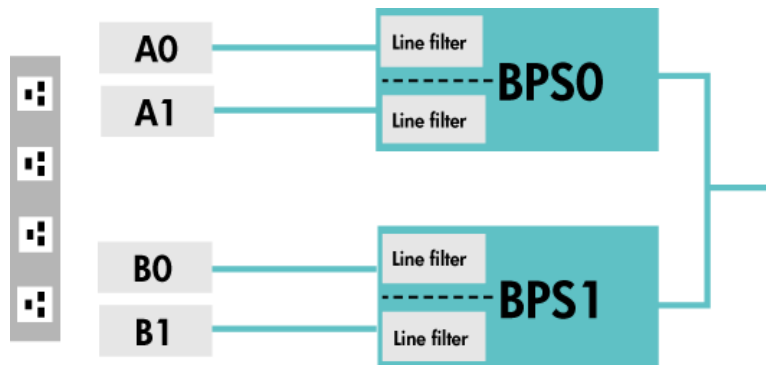
The benefit of this design is that when utilizing all four power cords, the Integrity rx7620-16 Server has 2N redundant power protection.

The dual AC modular bulk power supplies provide:

- Redundancy for both hardware failures and power input failures
- Hot-plug capability for any BPS in a redundant configuration
- Better data security, maintenance scheduling, and maintenance operations without system interruption



**Figure 19.** Power inputs and interconnects in the Integrity rx7620-16 Server are designed for fault-tolerant power compliance



### **Fault-tolerant power compliance in the Integrity rx8620-32 Server**

The AC input to the Integrity rx8620-32 Server is divided into four separate circuits. Each circuit is fed by any 50 to 60 Hz high line source through four line cords. (“High line” refers to 200–240 volt operation.) A minimum of two power cords is used to maintain normal operation of the Integrity rx8620-32 Server. A second set of two cords is added to improve system availability by protecting, for example, against power grid failures or accidentally tripped circuit breakers. Four power cords are used in order to enable redundancy and hot-swap functionality of the bulk power supplies. This power is routed from four individual 20-ampere circuit breakers via input line filters to six internal bulk power supplies. These four lines are labeled A0, B0, A1, and B1 at the line filter inputs on the back panel of the Integrity rx8620-32 Server.

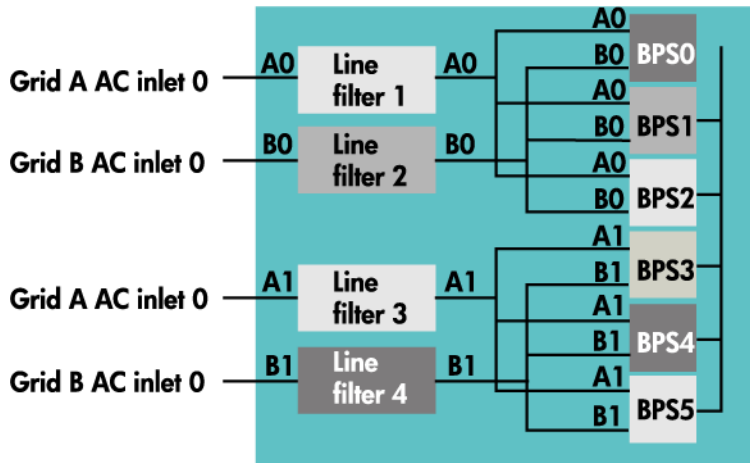
Figure 20 shows the Integrity rx8620-32 Server power configuration. Note that each AC inlet feeds three Integrity rx8620-32 Server bulk power supplies and that two separate AC inlets feed each bulk supply. The design of the individual BPSs and the configuration of the interconnect meet all the conditions for fault-tolerant power compliance.

Each BPS shown in Figure 20 can be thought of as two sub-power supplies housed in a single BPS module. If only Grid A power cords are used, only one of the two sub-power supplies is in use. The other supply is off until the Grid B cords are used. The benefit of this design is that when utilizing all four power cords, the Integrity rx8620-32 Server has 2N+1 redundant power protection.

The dual AC modular power supplies provide:

- The ability to purchase only the amount of power conversion necessary for the intended Integrity rx8620-32 Server configuration
- Redundancy for both hardware failures and power input failures
- Hot-plug capability for any BPS in a redundant configuration
- Better data security, maintenance scheduling, and maintenance operations without system interruption

**Figure 20.** Power inputs and interconnects in the Integrity rx8620-32 Server are designed for fault-tolerant power compliance



## AC power consumption

The power consumption of the HP Integrity rx7620-16 and rx8620-32 Servers varies greatly, depending on the hardware configuration and the input line voltages supplied at the customer site. HP represents power consumption in terms of volt-amperes (VA). There are two ways to represent consumption:

- **Theoretical maximum value** represents the maximum wattage of a given configuration, assuming worst-case conditions (thermal tolerances, workloads, and so forth) on all system components. It is extremely unlikely that a customer will experience power consumption at the level specified as the theoretical maximum.
- **Typical value** represents the expected power consumption of a given configuration. The typical value is the approximate power consumption that a customer will most likely experience. It can be used for power-budgeting purposes.

Following are the theoretical maximum and typical power consumption values for two different configurations of each server.

### HP Integrity rx7620-16 Server

- **Integrity rx7620-16 Server fully loaded configuration with eight traditional Intel Itanium 2 processors**—The Integrity rx7620-16 Server fully loaded configuration consists of eight 1.6 GHz Intel Itanium 2 processors, 128 GB of memory, 14 PCI-X cards, two cell boards, four internal hard drives, one DVD drive, two core I/O card sets, and two bulk power supplies.
  - Theoretical maximum power consumption: 3,220 VA (16.1 A @ 200 Vac)
  - Typical power consumption: 2,030 VA (10.2 A @ 200 Vac)
- **Integrity rx7620-16 Server average configuration with four traditional Intel Itanium 2 processors**—The Integrity rx7620-16 Server average configuration includes four 1.6 GHz Intel Itanium 2 processors, 10 GB of memory, five PCI-X cards, two cell boards, two internal hard drives, one DVD drive, one core I/O card set, and two bulk power supplies.
  - Typical power consumption: 1,100 VA (5.5 A @ 200 Vac)

## HP Integrity rx8620-32 Server

- **Integrity rx8620-32 Server fully loaded with 16 traditional Intel Itanium 2 processors**—The Integrity rx8620-32 Server fully loaded configuration consists of 16 1.6 GHz Intel Itanium 2 processors, 256 GB of memory, 16 PCI-X cards, four cell boards, four internal hard drives, two DVD drives, two core I/O cards, and six bulk power supplies.
  - Theoretical maximum power consumption: 5,400 VA (27.0 A @ 200 Vac)
  - Typical power consumption: 3,800 VA (19.0 A @ 200 Vac)
- **Integrity rx8620-32 Server average configuration with eight traditional Intel Itanium 2 processors**—The Integrity rx8620-32 Server average configuration includes eight 1.6 GHz Intel Itanium 2 processors, 16 GB of memory, eight PCI-X cards, two cell boards, two internal hard drives, one DVD drive, two core I/O cards, and four bulk power supplies.
  - Typical power consumption: 1,870 VA (9.35 A @ 200 Vac)

## Performance and scalability

The HP Integrity rx7620-16 and rx8620-32 Servers continue to provide leading-edge performance and scalability to the midrange server market. After factoring in racking density, HP midrange servers maintain performance density at least double that of the competition.

The following section summarizes the main performance and scalability characteristics of the Integrity rx7620-16 and rx8620-32 Servers.

### Important speeds and feeds

	Integrity rx7620-16 Server	Integrity rx8620-32 Server
Crossbar bandwidth (peak)	NA	16 GB/s
Cell controller to I/O subsystem bandwidth (peak)	4 GB/s	8 GB/s*
I/O slot bandwidth (peak)	16 GB/s	32 GB/s*
Memory bus bandwidth (peak)	32 GB/s	64 GB/s

### Scalability

	Integrity rx7620-16 Server	Integrity rx8620-32 Server
Cell boards	1–2	1–4
CPUs	2–8 1.6/1.5 GHz with Intel Itanium 2 processors 2–16 1.1 GHz Intel Itanium 2 processors with HP mx2 Dual-Processor Modules	2–16 1.6/1.5 GHz with Intel Itanium 2 processors 2–32 1.1 GHz Intel Itanium 2 processors with HP mx2 Dual-Processor Modules
Memory	2–128 GB	2–256 GB
Hot-plug PCI-X I/O slots (all 133 MHz × 64-bit)	15 slots	16 slots
Partitions	1–2	1–2 (4*)
Hot-plug internal disks	0–4	0–4 (8*)
Removable media	0–1	0–2 (4*)

\*Including SEU

## Performance benchmarks

The HP Integrity rx7620-16 and rx8620-32 Servers offer leadership performance in the online transaction processing (OLTP), business intelligence, and technical markets. More information will be available as benchmarks become certified.

## Racking

Both the HP Integrity rx7620-16 and rx8620-32 Servers provide industry-leading performance density and availability in a racked configuration. At 10 EIA units (17.5 inches), up to four Integrity rx7620-16 Servers can be mounted into a single HP 2-meter cabinet. At 17 EIA units (29.75 inches) each, two Integrity rx8620-32 Servers can be mounted into a single HP 2-meter cabinet, with 7 EIA units of extra space for mounting external peripherals.

The industrial design and packaging of the Integrity rx7620-16 and rx8620-32 Servers allow easy and quick access to all of the system components. The most frequently handled removable-media devices and disks are directly accessible at the system's front. Removing the front bezel allows complete servicing of hot-swap fans, hot-swap bulk power supplies, and PCI-X power supplies. At the rear, core I/O and more hot-swap fans are directly accessible.

The rackmount kit for the Integrity rx7620-16 and rx8620-32 Servers consists of the following:

- **Slide kit**—slides that safely support a fully configured product that must be serviced from the top and sides, so the slides must extend away from the rack front columns
- **Anti-lock mechanism**—A method of preventing sliding of more than one server from the rack at a time to prevent tipping over
- **Ballast weight (ordered separately using order number J1479D)**—A method of safely counterbalancing the HP Rosebowl II (RBII) rack enclosure when the product is deployed for servicing
- **Cable management arm**—A design to manage cable bundles at the rear of the product as the product slides

For access to all other components, the rackmounted versions come with rack slides. These enable the servers to slide forward out of the cabinet for servicing of internal components such as fans, cell boards, and I/O cards—even while the system is still operating.

The slides also allow for servicing or replacement of any field replaceable unit (FRU) without removing the chassis from the cabinet. In fact, you can access and remove any FRU within 15 minutes or less. This design reduces the downtime associated with system upgrades in the rare event of a component failure.

The interlock is a safety feature that is used when more than one product is to be installed in a single rack. This works only when two products are mounted on slides adjacent to each other (above and below) in a rack. The function of the anti-lock mechanism is to prevent sliding of more than one server from the rack at any given time. In the absence of this mechanism, if two servers are pulled out at the same time, the rack can tip over.

For stability during servicing, ballast kits are used on HP cabinets in which the Integrity rx7620-16 or rx8620-32 Servers are installed. The ballast weight base mount is designed to counteract the movement of one product in an HP RBII rack when extended out on its slides for servicing. The ballast weight also works in conjunction with the interlock mechanism to counteract the movement of one or two products in an HP RBII rack being extended out for servicing. Every system shipped to customers, excluding pedestal models, includes a ballast kit. The ballast weight easily attaches to the rear anti-tip foot that comes standard with every HP Rack System cabinet. Use of the ballast kit is mandatory for safety and for warranty validation, and the kit should be installed immediately.

Also included with every Integrity rx7620-16 and rx8620-32 Server is a cable management arm (CMA). The cable management arm is a two-member trough system that resides at the back of the chassis and guides cables during extension and retraction of the product. The CMA neatly secures data cables and prevents them from becoming entangled while the system is being serviced.

## Third-party racks

HP servers are designed to maximize performance density when installed into HP system cabinets. Moreover, HP system cabinets maintain the high level of safety and reliability that customers have come to expect. Although HP strongly recommends racking in HP cabinets, we recognize that some customer circumstances may prohibit this. Therefore, HP has developed guidelines that enable safe, reliable HP server installations in third-party cabinets. Because of the wide variety of cabinets in the marketplace, it is extremely important that the guidelines be followed explicitly. (See Chapter 4 in the *HP Server Configuration Guide* for the racking guidelines.)

## Server virtualization

Server virtualization helps administrators to optimize the usage and simplify the management of single- or multiple-server environments by configuring them as reusable pools of resources. Virtualization means that the physical resources are separated from the logical view of the server infrastructure. A number of solutions for vertically scaled environments are available from HP for the HP Integrity rx7620-16 and rx8620-32 Servers.

Vertical scaling typically means the use of a few consolidated high-performance servers to run many concurrent complex applications. This environment offers major opportunities for cost reduction and better utilization of existing assets. HP solutions for server partitioning and resource optimization can help administrators drive server utilization from a typical 15–50% to over 90% without service-level degradation. The combination of a virtualized server environment with HP Utility Pricing Solutions such as Instant Capacity and Pay per use (PPU) allows customers to activate additional capacity only when it is needed and to make payments for server resources based on actual usage.

The HP Partitioning Continuum provides a range of hard, virtual, and resource partitioning tools that offer resource virtualization at the server or partition level, improve overall system and subsystem utilization, and lower costs in consolidated environments. Partitions are physical or logical mechanisms for isolating operational environments within single or multiple servers. Partitioning provides IT managers with the flexibility of dynamically resizing an application's resource usage while making sure that all applications enjoy protection from disruptive events that could cause service interruption or performance degradation. The HP Integrity rx7620-16 and rx8620-32 Servers both offer the same mainframe-style partitioning capability. When coupled with the HP-UX operating environment, partitions in the HP Integrity rx7620-16 and rx8620-32 Servers allow a single system to be logically divided into multiple independent systems within the same server.

## nPartitions

Hard partitions in the Integrity rx7620-16 and rx8620-32 Servers are referred to as nPartitions (nPars). The "n" indicates that a partition actually has a wide number of functions that it can perform. These nPartitions provide a degree of isolation that can be utilized to consolidate several applications on a single server, give flexibility in resource management, and deliver improved availability and scalability.

## How nPartitions work

A hardware partition corresponds roughly to a single, standalone system. The Integrity rx7620-16 Server can be subdivided into two partitions, while the Integrity rx8620-32 Server (configured with an SEU) can be divided into four partitions. In the Integrity rx7620-16 Server, each partition will contain one cell board and its associated I/O resources. The Integrity rx8620-32 Server nPar can contain one or more cells that communicate coherently over a high-bandwidth, low-latency crossbar fabric. Cells are grouped into physical structures called cabinets or nodes. Special programmable hardware in the cells defines the boundaries of a partition in such a way that isolation from the actions of other partitions is enforced. Each partition runs its own independent instance of the operating system, and different nPartitions can be executing the same or different versions of an OS. In an HP Integrity rx7620-16 or rx8620-32 Server, they can even be executing different operating systems altogether (such as HP-UX, Linux, and Windows).

Each nPartition has its own independent set of CPUs, memory, and I/O resources. You can use system management commands to move resources from one nPartition to another without having to physically change the hardware. Dynamic additions of new nPartitions are also supported. Furthermore, maintenance can be performed on one nPar (including hardware additions or replacements) without any interruption to other nPars.

In vertically scaled servers, partitioning can be complemented by HP Utility Pricing Solutions to provide a number of options for implementing the infrastructure hardware and software required for on-the-fly expansions and reductions in computing power. Specific solutions for HP servers with HP-UX are Instant Capacity and PPU. Instant Capacity allows customers to activate processors within a partition or server when they are needed. (Processors can also be activated temporarily [Temporary Instant Capacity] to meet short-term demand, then deactivated and held again in reserve.) Cell board Instant Capacity also allows customers to add a complete cell board (CPUs and memory) to the system in standby mode, ready for activation when more processing capacity is needed. PPU solutions from HP are usage-based leasing solutions—customers pay only for the actual resources that are used. In terms of virtualization, HP Utility Pricing Solutions match expenditures directly to resources that are actually consumed by a specific IT service and can be activated only when they are really needed.

## High availability

High availability (HA) continues to be the hallmark of HP computer systems. But HP knows that delivering solutions that fully enable the highly available 24×7 operations demanded of today's businesses requires more than just delivering laundry lists of unusable HA features—or HA features with limited utility. The high-availability features of the HP Integrity rx7620-16 and rx8620-32 Servers actually address the real causes of customer downtime, as determined by actual field data from midrange computer users.

The HA features of the Integrity rx7620-16 and rx8620-32 Servers can be classified as those that address per-partition reliability and those that address intra-partition reliability—that is, single points of failure between hard partitions.

## Partition reliability

The Integrity rx7620-16 and rx8620-32 Servers have a design that is significantly “hardened” over other systems in their class. In fact, many of the features in these midrange systems can only be found in mainframes (or in HP Integrity Superdome). The reliability features within each Integrity rx7620-16 and rx8620-32 Server partition have been field-proven to provide high system reliability. And many customers who have taken advantage of these features report significantly lower hardware failure rates than with competitive systems.

### **CPU protection**

The central processing unit is often a major cause of system downtime. For instance, CPU cache errors are demonstrated to be a large contributor (in many cases, the greatest contributor) to unplanned system downtime. Furthermore, addition or modification of CPU resources is among the highest-ranking causes of planned hardware downtime. But in the Integrity rx7620-16 and rx8620-32 Servers, HP has designed specific features to combat CPU-caused downtime, including the following:

- Full error checking and correcting (ECC) on all caches
- Automatic deconfiguration of “faulty” CPUs (known as dynamic processor resilience [DPR])
- A highly effective and reliable CPU cooling scheme
- CPU hot-spares using HP Instant Capacity
- Redundant CPU power converters

### **ECC on caches**

The CPU caches in the Integrity rx7620-16 and rx8620-32 Servers are fully protected from single-bit hard errors and random soft errors generated from cosmic rays or other intermittent error-generation sources. Some competitive systems in the same class are not similarly protected, resulting in errors that are hard to debug and that are, in many cases, blamed on the customer environment. Such cache errors in these unprotected systems can result in failures that bring down multiple partitions.

Another advantage of the Integrity rx7620-16 and rx8620-32 Server CPU cache is its layout, which significantly reduces the chance of a multi-bit error due to a random cosmic ray strike. Such attention to detail is not found in many designs available from other vendors.

### **Automatic CPU deconfiguration**

Dynamic processor resilience (DPR) refers to the ability of the system to detect, de-allocate, and swap in spare CPUs online for CPUs that are generating an excessive quantity of recoverable cache errors. This protects the customer against the extremely unlikely event of a double-bit cache error. This is one example of the self-healing features of the HP hardware. Implementation of this feature results in no downtime or performance loss. This feature is not currently supported with Windows or Linux.

### **CPU cooling**

Heat is the big enemy of electronic components. But the Integrity rx7620-16 and rx8620-32 Servers’ two-level cooling scheme offers outstanding cooling capacity at a nominal cost. The servers’ turbo-cooler fans draw air directly into the heat sinks of the CPU and cell VLSI. At the extreme operating ranges of the Integrity rx7620-16 and rx8620-32 Servers, the turbo-cooler fans keep temperatures well below the maximum values allowed. Even though the turbo-coolers may not be required under normal operating conditions, running them assures that the silicon chips operate at the lowest temperature, helping to ensure maximum lifetime.

To further improve reliability of the Integrity rx7620-16 and rx8620-32 Servers, manageability software monitors the speeds of all fans, including turbo-cooler fans. The Integrity rx7620-16 and rx8620-32 Servers’ smart fan controller can detect the first hint of slowdown associated with bearing wear, making sure you get plenty of warning before a fan fails.

### **Instant Capacity**

Instant Capacity is a means of adding and removing CPUs in a partition. With Instant Capacity, you don't need to worry about the following:

- Interleaved memory
- Application-locked memory
- Server switchovers due to false failures
- Physically handling CPU or memory boards
- Rebooting

Instant Capacity is the most reliable means of reducing planned downtime for hardware upgrades. It is only supported with HP-UX at this time.

### **Memory protection**

Main memory failures are the single largest cause of customer downtime. The Integrity rx7620-16 and rx8620-32 Servers have several features designed to reduce or eliminate failures of memory:

- Chip spare tolerance
- Dynamic memory resiliency (DMR)
- Automatic deconfigure on reboot
- Hardware memory scrubbing
- Industry leadership address/control parity protection

Chip spare tolerance is the ability of the system to continue to run in the face of any single- or multi-bit chip error on a DRAM. The DRAMs in the Integrity rx7620-16 and rx8620-32 Servers can be thought of as N+1 per set of 128 DRAMs. This functionality is essential in the design of reliable memory systems, and systems without this feature are doomed to fail at an alarming rate compared to the Integrity rx7620-16 and rx8620-32 Servers. (This has been demonstrated at customer sites that use both chip spare tolerance and less reliable architectures.)

There are many ways that DRAMs can fail, especially when a system has hundreds of them. It is hopeless to try to design around (or explain away) this simple fact. With HP's chip spare technology, the Integrity rx7620-16 and rx8620-32 Server memory is extremely reliable.

### **Dynamic memory resiliency (DMR)**

Dynamic memory resiliency is the system's ability to de-allocate failed memory pages online. This feature is similar to dynamic processor resiliency; if a location in memory proves to be questionable (that is, exhibits persistent errors), the memory is de-allocated online with no customer-visible impact. Assuming the Integrity rx7620-16 and rx8620-32 Servers are equipped with adequate memory to begin with, it is likely that the failed memory will never have to be replaced over the life of the product, resulting in a significant reduction in both planned and unplanned downtime. DMR is superior to industry-available hardware-only techniques because hardware-only techniques can quickly run out of spares. HP's page de-allocation technique solves this problem, resulting in more spares than can possibly be used over the life of the machine.

### **Hardware memory scrubbing**

Software-based memory scrubbers are limited in function due to the fact that many operating systems and applications "lock down" memory, resulting in no possible access. HP's hardware scrubber "cleans" memory without OS or application knowledge, resulting in much better coverage.



### Address/Control parity

The address control path of the memory system is protected so that spurious bit flips in the address/control path do not cause the correct data to be written to the wrong location, which would result in data corruption. HP is the leader in delivering this functionality to the mission-critical marketplace.

### Protection for I/O

I/O errors are another significant cause of hardware errors and downtime because the number of I/O cards in a typical system is significant, and the I/O cards themselves are a part of the system most exposed to frequent human interaction in the data center.

In order to prevent downtime due to I/O errors, HP has designed the following features into the Integrity rx7620-16 and rx8620-32 Servers:

- Online replacement of PCI-X cards
- Hardware “firewall” of I/O errors to cell
- High mean time between failures (MTBF) for I/O cards
- Separate PCI-X buses for each I/O card

Taken together, these features will reduce hardware downtime by at least 20% over similar servers.

### Integrity rx8620-32 Server crossbar backplane protection

The backplane of the Integrity rx8620-32 Server ties CPU and memory together. Because all partitions share the backplane, high reliability and true domain isolation are very important. The specific features that address these areas are as follows:

- **Highly reliable ASICs**—The backplane ASIC is manufactured and tested with a process that results in 10X demonstrated reliability over comparable chips. This reliability results in virtually zero backplane ASIC failures in the field.
- **Redundant DC–DC converters**—The DC–DC converters that power the backplane chips are fully redundant, reducing downtime associated with power conversion. (Power conversion is normally a significant contributor to failure rate.)
- **Full end-to-end error correction and independent-partition design**—The backplane is built from a single crossbar with point-to-point connections. Traffic within a partition is contained in that partition, so there is no sharing of links in a properly configured system. Each port of the crossbar chip is fully independent, allowing cells of different partitions to coexist without affecting each other in any way. In other bus-based systems, all domains participate in the coherency scheme and share address buses. Therefore, in these systems all domains are linked in some fashion, resulting in shared failure modes that might crash multiple partitions.

Also, unlike other snoopy coherency systems that must accept and respond to all coherency requests from all domains, Integrity rx8620-32 Server partitions have hardware firewalls dedicated to guarding partitions from errant transactions generated on failing partitions. A failure in one Integrity rx8620-32 Server partition will not affect any other partitions.

Finally, all data paths in the fabric are resistant to both random single-bit errors and persistent single-wire “stuck-at” faults. Therefore, the fabric is resilient to any single-bit failure, including pin, connector, or solder problems.

## Reliability in the cabinet infrastructure

In keeping with its focus on maintaining high availability (HA), the Integrity rx7620-16 and rx8620-32 Servers include protection against failure within the cabinet infrastructure. The HA features in this area include true dual AC line cord support and complete resilience to service processor failures.

### **Dual AC line cord support**

As described earlier in this paper, the Integrity rx7620-16 and rx8620-32 Servers can run on one or two totally independent power sources. Moreover, these two power sources do not need to be in phase or the same voltage.

### **Resilience to service processor failures**

The Integrity rx7620-16 and rx8620-32 Server hardware has been designed to enable service processor failover when redundant core I/O cards are in place. Future firmware and manageability code releases will allow a secondary service processor to take over for a failed service processor and will also enable a resilient console (on reboot). Future OS releases may allow the console to fail-over as well.

HP continues to make great strides in implementing features that reduce the time to upgrade components or diagnose and repair component failures. The Integrity rx7620-16 and rx8620-32 Servers were designed with the objective of coupling state-of-the-art diagnostic tools with hardware features to virtually eliminate unplanned downtime. Hot-swap and hot-plug technology is implemented throughout the server, allowing addition or replacement of components while the system continues to run.

For components that cannot be serviced while the server is running, both servers were designed to provide access and removal of any field replaceable unit (FRU) within 15 minutes or less. In addition, the Integrity rx7620-16 and rx8620-32 Servers are loaded with design innovations that greatly simplify servicing.

## **Enhanced serviceability**

The following is a list of enhanced serviceability features:

- Hot-plug functionality for internal disks and PCI-X cards
- Hot-swap functionality for bulk power supplies and cooling fans
- 26.75-inch product length from mounting column to the connector-mating surface at rear (~30 inches overall with the front bezel sitting forward of the rack column), leaving four inches for cable bending in third-party racks
- PCI-X card access from the top of the chassis so that ceiling light enhances visibility
- Access panels as large as possible to enhance the service access area
- Five-sided access to increase accessibility
- Independent access to major FRUs; any FRU can be accessed and removed within 15 minutes or less
- Access to most commonly serviced components from the front or rear without moving the product in the rack

## **Investment protection**

The HP midrange server family provides outstanding customer investment protection and lasting value, with a system infrastructure designed to accommodate several generations of processor upgrades. For the HP Integrity rx7620-16 and rx8620-32 Servers, this means supporting state-of-the-art Intel Itanium 2 processors today, with the ability to perform in-the-box upgrades to multiple generations of future Intel Itanium processors. No other competitor in this arena can offer the investment protection provided by HP midrange servers.

All major system components, other than the power conversion board, are slated to remain the same for future processors—you can even use the same memory DIMMs. This makes upgrading easy and economical: You simply remove all the cells and the memory contained within the cells, transfer the memory to the processor cell boards, and install the processor cell boards into the cabinet. In addition, HP is investing in several PA-RISC enhancements in addition to those in the Intel Itanium processor. This allows customers to move to the new architecture when they are ready, not when their vendor forces them to. The HP dual-path microprocessor roadmap helps make the Integrity rx7620-16 and rx8620-32 Servers the safest and fastest midrange servers in the market.

## Binary compatibility for the Intel Itanium Processor Family

HP will continue to support binary compatibility of operating systems through the introduction of Itanium-based systems. As a result of HP's work with Intel on Explicitly Parallel Instruction Computing (EPIC) architecture—the technology foundation for the Intel Itanium architecture—today's HP-UX, Windows, and Linux applications will run unchanged on Itanium-based systems. To help facilitate maximum performance, you can recompile applications without source changes.

## Upgrading the HP Server rp7410 and rp8400

The HP Server rp7410 and rp8400 were the first releases of the current generation of the HP midrange server family. These PA-8700 RISC-based servers can be easily upgraded to an Integrity rx8620-32 Server containing Intel Itanium 2 processors. Upgrading the rp7410 and rp8400 servers is simple.

- Remove the cell boards
- Transfer all memory to the new cell board
- Plug the cell board into the cabinet
- Remove/Replace existing core I/O(s)
- Remove/Replace I/O backplane board
- Upgrade system firmware (as needed)
- Install desired operating system
- Change system bezel to reflect the correct system name and color scheme

Today's HP midrange servers are already prepared for the next generation of processors so that they can stay ahead of tomorrow's performance demands. HP Integrity servers deliver investment protection through multiple significant in-chassis upgrades.

## Instant Capacity

With HP Instant Capacity solutions, the Integrity rx7620-16 and rx8620-32 Servers can be fully populated with high-performance Intel Itanium 2 processors at a significantly lower cost. (Instant Capacity is not supported with Windows at first release.) It is no longer necessary to pay for inactive CPUs—with Instant Capacity you only pay when you start using the extra capacity. These additional CPUs can be activated instantly with a simple command, providing immediate increases in processing power to accommodate application traffic demands.

Instant Capacity is also a high-availability feature. In the unlikely event that a CPU fails, the HP system will automatically replace the failed CPU on the cell board at no additional charge—without rebooting! In online mode, the Instant Capacity CPU brings the system back to full performance and capacity levels, reducing downtime and assuring no degradation in performance.

Temporary Instant Capacity is the ability to turn Instant Capacity CPUs that are already installed in the system on and off for short periods of time to provide added capacity. Temporary Instant Capacity gives customers the ability to adjust to unplanned or planned spikes in computing.

Cell board Instant Capacity extends the Instant Capacity value proposition to include a complete standby cell board (CPUs and memory) in the system for a fraction of the cost. When processing capacity is needed, simply activate the cell board (memory and at least one CPU) to immediately increase the compute power of the server.

HP Instant Capacity tools use the following algorithm to activate new processors:

1. Verify that there is at least one active CPU per cell board
2. Activate CPUs round-robin style across cell boards within a partition—the number of active processors per cell board will differ by, at most, one across the partition
3. Enable CPUs on a cell board in the order 0, 1, 2, 3; this spreads the CPUs across the two internal cell controller buses and allocates CPUs in the best thermal fashion
4. When a failed CPU is replaced, choose one from the same cell board when possible; if that is not possible, choose the next available CPU, following rules 2 and 3

For best performance, all cell boards in the same partition should contain the same number of active processors. For high-availability reasons, each cell board should contain at least two active processors.

## Ease of management

As the number of servers grows and server farms proliferate, IT professionals have come to realize that the cost of managing these servers can add up to many times the actual cost of hardware. In the HP Integrity rx7620-16 and rx8620-32 Servers, HP has provided features to make management easier and less taxing. Add HP management software that interfaces seamlessly with the Integrity rx7620-16 and rx8620-32 Servers, and you're assured of a lower total cost of ownership (TCO) and higher overall efficiency.

## Management Processor

Both servers have a dedicated Management Processor (MP) that simplifies and extends system management and enhances serviceability. The MP feature set was designed to reduce or eliminate the need for the system administrator to be physically at the system to perform tasks such as diagnostics, system management, or even hard resets.

## Partition Manager software

The Integrity rx7620-16 and rx8620-32 Servers come with HP Partition Manager (parmgr) software, which makes specifying, setting up, and reconfiguring partitions easy and straightforward. You can launch Partition Manager as a GUI from HP System Administration Manager (SAM) or directly from the command line. Partition Manager running on HP-UX can manage Windows and Linux partitions.

These are some of the things you can do with Partition Manager:

- Display server status
- Create, delete, and modify nPartitions
- Display a complete hardware inventory
- Display status of key server components
- Check for problems or unusual server conditions
- Manage power to cells and I/O chassis
- Toggle attention indicators for cells, I/O chassis, I/O cards, and cabinets

Partition Manager on HP-UX 11i v2 is significantly improved and includes these new features:

- A new Web interface
- Graphical “big picture” views of nPars and hardware components
- Easy-to-see status lights
- Smart action menus that adjust according to selected element
- Remote administration

Additional Partition Manager features are available on HP-UX servers:

- It can be launched by Servicecontrol Manager 3.0
- It is aware of Instant Capacity/Pay per use systems

## HP-UX

Servicecontrol Manager is the central point of administration for management applications that address the configuration, fault, and workload management requirements of an infrastructure that is more adaptive. Servicecontrol Manager maintains both effective and efficient management of computing resources. It integrates with many other HP-UX-specific system management tools, including the following tools available on Integrity servers:

- **Ignite-UX** addresses the need for HP-UX system administrators to perform fast deployment for one or many servers. It provides the means for creating and reusing standard system configurations, enables replication of systems, permits post-installation customizations, and is capable of both interactive and unattended operating modes.
- **Software Distributor-UX (SD-UX)** is the HP-UX administration toolset used to deliver and maintain HP-UX operating systems and layered software applications. Delivered as part of HP-UX, SD-UX can help you manage your HP-UX operating system, patches, and application software on HP Integrity servers.
- **System Administration Manager (SAM)** is used to manage accounts for users and groups, perform auditing and security operations, and handle disk and file system management and peripheral device management. Servicecontrol Manager allows these tasks to be distributed to multiple systems and delegated using role-based security.
- **HP-UX Kernel Configuration** is used for self-optimizing kernel changes. The new HP-UX Kernel Configuration tool allows users to tune both dynamic and static kernel parameters quickly and easily from a Web-based GUI to optimize system performance. This tool also sets kernel parameter alarms that notify you when system usage levels exceed thresholds.
- **Partition Manager** creates and manages nPartitions—hard partitions for high-end servers. Once the partitions are created, the systems running on those partitions can be managed consistently with all the other tools integrated into Servicecontrol Manager.

- **Security Patch Check** determines how current a system's security patches are, recommends patches for continuing security vulnerabilities, and warns administrators about recalled patches still present on the system.
- **System Inventory Manager** is for change and asset management. It allows you to easily collect, store, and manage inventory and configuration information for HP-UX-based servers. It provides an easy-to-use, Web-based interface, superior performance, and comprehensive reporting capabilities.
- **Event Monitoring Service (EMS)** keeps the administrator of multiple systems aware of system operation throughout the cluster, and it notifies the administrator of potential hardware or software problems before they occur. HP Servicecontrol Manager can launch the EMS interface and configure EMS monitors for any node or node group that belongs to the cluster, resulting in increased reliability and reduced downtime.
- **Management Processor** enables remote server management over the Web, regardless of the system state. In the unlikely event that the operating system is not running, the Management Processor can be accessed to power cycle the server, view event and status logs, enable console redirection, and more. The Management Processor is embedded into the server and does not take a PCI-X slot.
- **Process Resource Manager (PRM)** controls the resources that processes use during peak system load. PRM can manage the allocation of CPU, memory resources, and disk bandwidth. It allows administrators to run multiple mission-critical applications on a single system, improve response time for critical users and applications, allocate resources on shared servers based on departmental budget contributions, provide applications with total resource isolation, and dynamically change configuration at any time—even under load.
- **HP-UX Workload Manager (WLM)** provides automatic CPU resource allocation and application performance management based on prioritized service-level objectives (SLOs). In addition, WLM allows administrators to set real memory and disk bandwidth entitlements (guaranteed minimums) to fixed levels in the configuration. The use of workload groups and SLOs improves response time for critical users, allows system consolidation, and helps manage user expectations for performance.
- **OpenView Operations Agent** provides a fully integrated, single-pane-of-glass management solution for systems, networks, applications, and databases. A powerful ability to monitor, filter, correlate, and respond to events enables IT organizations to establish central management control over their managed environments and improve overall availability and reliability.
- **OpenView Performance Agent** monitors and analyzes the performance of systems and applications to compare service-level objectives with actual application performance, and it enables real-time performance monitoring as well as action on alarm.
- **OpenView Glanceplus** is a powerful system monitoring and diagnostic tool that provides online performance information, examination of system activities, identification and resolution of performance bottlenecks, and system fine-tuning.
- **OpenView Data Protector (Omniback II)** provides reliable, high-performance data protection for enterprise-wide heterogeneous environments without impacting system or application performance. It centralizes and automates backup and recovery operations and tracks file versions and media to enable swift recovery of information.
- **OpenView Network Node Manager (NNM)** management station runs on Itanium 2-based HP-UX servers. NNM provides a powerful network management solution that includes concise, in-depth views of network devices and their status in an intuitive graphical format. NNM helps network managers evaluate network performance, pinpoint problem sources, and proactively manage their networks and network availability.

All other HP OpenView management tools, such as OpenView Operations, Service Desk, and Service Reporter, will be able to collect and process information from the agents running on Integrity servers with HP-UX.

## Windows

The **HP Integrity Essentials Foundation Pack for Windows** is a complete toolset for installing, configuring, and managing HP Integrity rx7620-16 and rx8620-32 Servers running Windows. The following tools are included in the package:

- **Smart Setup DVD** includes an EFI-based setup utility (EBSU) designed for easy server and array controller configuration. The DVD also includes all the latest tested and compatible drivers, HP firmware, HP utilities, and HP management agents that assist in the server deployment process (by preparing the server for installation of a standard Windows operating system) and in the ongoing management of the server.
- **Insight Manager 7** increases system uptime and provides powerful monitoring and control. Insight Manager 7 delivers pre-failure alerting for servers, so potential server failures are detected before they result in unplanned system downtime. Insight Manager 7 also provides inventory reporting capabilities that dramatically reduce the time and effort required to track server assets and that help system administrators make educated decisions about which systems may require hardware upgrades or replacement. And Insight Manager 7 is an effective tool for managing your HP desktops and notebooks as well as non-HP devices instrumented to simple network management protocol (SNMP) or desktop management interface (DMI).
- **System Management Homepage for HP Integrity servers with Windows** helps system administrators rapidly respond to potential and actual system failures, increases system stability, and reduces troubleshooting complexity. It provides consolidated information about system health and configuration through a simple, Web-based user interface. All system faults and major subsystem status are reported within the System Management Homepage. The System Management Homepage is accessible either directly through a browser or through a management application such as Insight Manager 7 or an enterprise management application. (Available only on the 8-, 16-, and 32-socket systems.)

These tools are also available for managing HP Integrity servers running Windows:

- **Management Processor** enables remote server management over the Web, regardless of the system state. In the unlikely event that the operating system is not running, the Management Processor can be accessed to power cycle the server, view event and status logs, enable console redirection, and more. The Management Processor is embedded into the server and does not take a PCI-X slot.
- **Microsoft Windows System Resource Manager (WSRM)** provides resource management and enables the allocation of resources, including processor and memory resources, among multiple applications based on business priorities. An administrator sets targets for the amount of hardware resources that users or running applications are allowed to consume. This means resources can be allocated among multiple applications on a server according to business priorities.
- **HP OpenView management tools**, such as OpenView Operations and Network Node Manager, will be able to collect and process information from the SNMP agents and WMI running on Itanium 2-based Windows servers, proactively monitoring and measuring the availability and performance of heterogeneous servers and applications from a services perspective and a Windows NT®/2000 management platform. In the future, OpenView agents will be able to directly collect and correlate event, storage, and performance data from Itanium 2-based Windows servers, enhancing the information OpenView management tools will process and present.



## Linux

The following tools are also used to manage HP Integrity rx7620-16 and rx8620-32 Servers running Linux.

- **Insight Manager 7** increases system uptime and provides powerful monitoring and control. Insight Manager 7 also provides inventory reporting capabilities that dramatically reduce the time and effort required to track server assets, and it helps system administrators make educated decisions about which systems may require hardware upgrades or replacement. And Insight Manager 7 is an effective tool for managing your HP desktops and notebooks as well as non-HP devices instrumented to SNMP or DMI.
- **The HP Enablement Kit for Linux** facilitates setup and configuration of the operating system. This kit includes SystemImager, an open-source operating-system deployment tool. SystemImager is a golden image-based tool that can be used for initial deployment as well as updates.
- **Partition Manager** creates and manages nPartitions—hard partitions for high-end servers. Once the partitions are created, the systems running on those partitions can be managed consistently with all the other server management tools available for Linux servers. At first release, Partition Manager will require an HP-UX 11i v2 partition or separate device (e.g., Itanium 2-based workstation or server running HP-UX 11i v2) in order to configure Linux partitions.
- **Management Processor** enables remote server management over the Web, regardless of the system state. In the unlikely event that the operating system is not running, the Management Processor can be accessed to power cycle the server, view event and status logs, enable console redirection, and more. The Management Processor is embedded into the server and does not take a PCI-X slot.
- **HP OpenView management tools**, such as OpenView Operations and Network Node Manager, will be able to collect and process information from the SNMP agents running on Itanium 2-based Integrity servers with Linux.

## HP Services for the HP Integrity rx7620-16 and rx8620-32 Servers

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Services and support for each operating system will be available at the time the specific operating system is available or supported by the server.

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### Evolve your infrastructure confidently with a partner that stands accountable

When you're ready to take advantage of the performance improvements Itanium-based computing offers, HP has a full range of multi-OS services to help make the transition as seamless and painless as possible. We'll help you quickly and confidently introduce HP Integrity systems into your existing IT environment and capitalize on their potential for your business. We offer assessment services to precisely define porting requirements and chart a course to deployment, implementation services to install and configure equipment rapidly, and education services to provide your staff with the expertise required to achieve optimal system performance. Throughout the evolution process, HP accepts full accountability for delivering on the service commitments that we and our partners have made. And our commitment to your satisfaction doesn't stop with the transition process itself. Our multi-OS support offerings—from simple reactive to comprehensive mission-critical—reduce the risks associated with downtime once your HP Integrity systems are installed. We are looking ahead to help with your long-term success by working with leading independent software vendors (ISVs) in both the technical and commercial markets to tailor their applications to the Intel Itanium 2 architecture and HP



mx2 Dual-Processor Module technology, thereby exploiting the full potential of your HP Integrity servers.

HP Services delivers end-to-end solutions that offer consistent quality and service levels across multiple platforms such as UNIX®, Windows, and Linux, as well as systems from other well-known vendors. With the introduction of the midrange servers based on the Intel Itanium 2 microarchitecture and HP mx2 Dual-Processor Modules, HP is the only vendor that offers the services to support the implementation of multiple operating systems (UNIX, Windows, and Linux) on a single Itanium-based server. HP Services will utilize its wide range of offerings and its experienced services personnel to help companies fully exploit the Intel Itanium architecture's capabilities while protecting their existing infrastructures.

## Full lifecycle services

HP Services offers a portfolio of services that meet your business requirements across your IT lifecycle. Whether it's a discrete short-term engagement or a full-scale project deployment, HP helps you fully exploit the Intel Itanium architecture's capabilities while protecting your existing infrastructures and IT investments by positioning you to meet your evolving business needs.

- **Evaluation and planning**—HP Services experts help your company determine the best strategy for seamlessly integrating Itanium-based systems into your existing infrastructure to improve performance, reduce costs, and gain control of your IT environment. Working closely with your team, HP helps you develop an architecture that matches your IT environment to your business requirements and then creates a detailed migration plan that provides specific recommendations based upon your IT needs.
- **Porting and migration**—HP offers flexible porting and migration services that help you retain or enhance your application functionality, reduce disruptions during migration, and take full advantage of the distinctive capabilities of the Intel Itanium architecture. HP will work with you to determine your porting and migration needs, devise a strategy for moving applications to Itanium-based platforms, and create a detailed migration plan. And HP can manage all the details, including porting and migrating your applications, migrating your data, integrating your applications with existing ones, and performing application tuning, if that's what you need.
- **IT consolidation**—HP offers IT consolidation solutions that help you enhance the use of your IT resources, achieve new performance and productivity levels, and evolve your IT environment to meet changes in demand. HP Services personnel help you identify your company's business and IT objectives, create an investment justification and architectural blueprint, develop a detailed design plan that incorporates specifics on the configuration and technologies of your company's solution, and deliver a complete, tested infrastructure implementation.
- **Deployment**—HP Services personnel have the experience and expertise to deliver services that can help reduce the risks, time, and costs associated with deploying new technology. Acting as your single point of contact, HP develops and implements a deployment plan—including configuration, testing, and installation of all equipment—that helps provide the seamless deployment of Itanium-based solutions into full production.
- **Ongoing support**—HP offers a variety of support levels that cover your entire IT infrastructure and meet your specific needs. Companies can count on HP Services to help them acquire the assistance they need to maintain control of and deliver business value through their IT investments. You benefit from proactive onsite services, defined escalation processes, and rapid fixes. Corresponding HP services for your storage and network systems provide an integrated support solution for your environment.
  - **Hardware and software support:** HP has a full spectrum of proven preventive, diagnostic, remedial, and repair services that include high-quality remote and onsite support, upgraded hardware service response times and coverage periods, fast and reliable access to HP response centers for software phone-in assistance, and software updates for selected HP and third-party products.

- **Integrated support:** Support Plus and Support Plus 24 are integrated hardware and software services that are available to customers who require assistance that complements their internal IT resources. HP Proactive 24 Service includes proactive advice and assistance that helps you improve the effectiveness of your IT environment.
- **Mission-critical support:** In order to reduce exposure to downtime, HP can deliver mission-critical support for businesses running critical applications. HP uses proven processes, best practices, and leading remote support technologies to help provide maximum IT availability and performance. The Critical Service offering combines proactive and reactive services, including availability assessments and modeling, benchmarking, performance optimization, remote monitoring, security, capacity planning, configuration, availability, and performance management services. No other vendor matches our worldwide standard 6-hour call-to-repair commitment (subject to specific terms and conditions). In addition, through the HP Mission Critical Partnership, you have the opportunity to create a custom agreement with HP to achieve your business objectives through customized business-level commitments that eliminate exposure to abrupt negative acts.
- **Education**—HP offers a full curriculum of education courses that can help improve the productivity and performance of your workforce. Through these courses, programmers and IT administrators can quickly become in-house experts on the Intel Itanium architecture and the operation of Itanium-based solutions for HP-UX, Linux, and Windows. Courses are delivered using a variety of methods—from customized onsite classes to self-paced, Web-based sessions—that meet your company’s learning requirements.
- **Technical services**—Even the most technically proficient IT staff may need assistance when implementing and managing its Itanium-based platforms. That’s why HP offers technical services—discrete, focused engagements that provide on-demand expertise to supplement your own IT resources. HP delivers proactive technical consulting services across the entire IT lifecycle, from assessment and planning to high availability and performance to security and system administration.
- **Business-continuity services**—HP business-continuity offerings—including consulting, disaster-tolerant, business-recovery, and backup and recovery services—can protect your critical high-value business processes against potentially serious outages. HP uses a proven best-practices-based methodology to design and implement a solution and continuity plan that fits your company’s specific business needs.
- **Managed services**—HP offers comprehensive managed services that deliver innovative on-demand and traditional outsourcing services to simplify the management of your IT infrastructure and reduce costs while helping you quickly address changes in the marketplace. Our proven, flexible approach enables you to outsource your entire IT infrastructure—hardware, processes, and people—with the knowledge that you will receive predictable support levels based upon approved service-level agreements.

## The HP difference

HP Services provides a full range of services to help companies like yours quickly and confidently introduce Itanium-based systems into their IT infrastructures. Through our world-class methodologies, proven processes, IT expertise, advanced support technologies, and partnerships with industry leaders, HP Services can help you gain the full benefits from this technology—optimal resource utilization, reduced costs, and improved return on IT investment.

HP provides consistent delivery of its services via a global network of operations, education, and competency centers. HP Services employs more than 65,000 skilled and experienced professionals working in more than 160 countries, including 18,000 experts in UNIX, 28,000 in Microsoft, and 3,000 in Linux. Through this expertise, companies are assured of end-to-end solutions that offer consistent quality, availability, and cost across multiple platforms and operating systems.

## Proven experience and expertise

Our global network of services personnel have unmatched experience and expertise deploying go-to-market solutions using best-in-class processes across the lifecycle. And no matter what services you choose—from assessment or porting and migration to complete deployment and education offerings to ongoing support or full outsourcing solutions—HP will help you take advantage of this next-generation architecture quickly and cost-effectively.

To learn more about HP Services, visit: [www.hp.com/hps/](http://www.hp.com/hps/)

## For more information

For more information, please visit our server Web site at: [www.hp.com/go/servers](http://www.hp.com/go/servers)

Visit the HP Integrity rx7620-16 Server Web site at: [www.hp.com/go/rx7620](http://www.hp.com/go/rx7620)

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